from the nucleus of the nerve cell is noted and the cell outgrowths discussed with special reference to the axis-cylinder prolongation as demonstrated by Golgi's method. The author seems to us unduly skeptical on this particular point, though his arguments against the simple nutritious functions of the protoplasmic prolongations have more force. Our principle indictments against this chapter is that he still speaks of nerve-cells and fibres as separate elements, thus failing to utilize the valuable conception of the cell and its fibres as forming both a morphological and physiological unit.

Beginning with the spinal cord we come to the most valuable portions of the book. Here Cajal's results are freely used. The view that the columns of Goll are pathways for the muscle sense is supported by the observation that these columns are poorly developed in the limbless forms. The segmental nature of the spinal cord is passed over on the ground that it is but faintly indicated in the higher mammals—not a very sufficient reason.

In discussing the spinal nerves their double origin—from both sides of the cord—is described and this idea is carried over to the cranial nerves where even the patheticus and abducens are forced into the schema. One cannot help feeling in the light of v. Guddins's results, that the weight of evidence is against such a view. The new figures (134-136) in the section on the medulla and interbrain form welcome illustrations of the latter region. If an argument were needed to show how much the histologist had yet to do on the nerve centres, no better one could be offered than the fact that the olfactory bulb and tract are here illustrated and considered from the examination of them in the dog. The contribution of His to the make up of the olfactory bulb is not mentioned and the double nature of the optic nerve is passed over. Farther on, the anatomical myth about the fibres of the Callosum joining identical points of the cortex appears. This is pure hypothesis and should not be presented as anything else.

Finally, the pictures illustrating the cortex (p. 445) are all out of drawing. The size of the cells and the relative thickness of the several layers are both calculated to give wrong impressions, which are only in part to be corrected by the figure on p. 451 illustrating the distinction of fibres in the cortex.

References to the more important literature have been introduced at the end of each section and in many cases the abbreviations used in connection with the figures have been arranged in alphabetical order in the explanation, thus facilitating reference. The foregoing remarks are intended simply as a running comment to the thanks due the author from those who have occasion to use his lucid and instructive book.

TURNER, *The convolutions of the brain; a study in comparative anatomy*, Jour. of Anat. and Physiol., 1890-1, XXV, 105, also *Verhandlungen des X. internationalen medicinischen Congresses, Berlin 1890*, II. Berlin 1891.

This paper is valuable for the simple and novel form in which it presents the comparative anatomy of the gyri. Lacking, as we do, a really adequate theory of the formation of the gyri from the physiological side, it is necessary to come back to the comparative anatomy for the significance of these foldings; from this latter standpoint our author reviews the field.

He makes departure from the very general fact that a cerebral hemisphere is separable into two natural divisions—a ventral portion, or Rhinencephalon, and a dorsal portion, or Pallium. These main divisions are separated by the rhinal or ects-rhinal fissure.

So far as the rhinencephalon is concerned Turner follows Broca in making it the basis for a further grouping. Instead of Broca's two

groups of osmatic and anosmatic animals, Turner makes a threefold division into macrosmatic, represented by the Ungulata, Carnivora, etc., microsmatic represented by the Pinnipedia, whalebone-whales, apes and man, and finally the anosmatic, represented by the dolphins, toothed-whales, etc.

In ascending the mammalian series the pallium developes the more rapidly and thus more and more overgrows the rhinencephalon. As a result the rhinal fissure passes from a lateral position in the lower forms, to a ventral one, in the higher. The main subdivisions of the rhinencephalon are the bulb, peduncle and lobus hippocampi. Two roots of the peduncle are described; these bound the quadrilateral space. Of course with the variations in the size of both pallium and rhinencephalon the topographical relations of the latter may be various. The lobus hippocampi is in general larger in the microsmatic animals than in the anosmatic, but it is still present in the gross form in the latter. Supposing that in this last case it contains normal nerve elements, we are in the position of being forced to explain a special-sense centre which has no peripheral connections. There seem two ways out of such a position; either to find that the hippocampal lobes are histologically abnormal in the anosmatic forms or that this region has some other function in addition to a centre for smell. It is not improbable that both these notions would be involved in any complete explanation. In all animals the pallium is larger than the rhinencephalon, the difference being greatest in the higher forms. Species in the same order may have in some cases a convoluted pallium, in others a smooth one. The insectivora are apparently the group in which the surface of the hemispheres most perfectly preserves its smoothness throughout life in all the genera. In the monotremata, Ornithorhyncus has a smooth brain while that of Echidua is convoluted After considering the orders in which the pallium is slightly convoluted our author notes the order of appearance of the fundamental fissures in these forms and shows that, while the sylvian fossa is to be associated with the rhinencephalon, the sylvian fissure belongs to the pallium. Further among the lissencephala—or smooth-brained forms—the sylvian fissure is by no means necessarily the first to appear. In many forms there is a tendency to the formation of a sagittal fissure and marginal gyrus before the sylvian can be recognized. Taking the fundamental fissures it is evident that there is no fixed order for their appearance but that the order differs according to the groups of animals examined.

For purposes of general description Turner groups the fissures into sagittal, arcuate and radial, terms which hardly require further explanation.

Taking up first those orders in which the convolutions are most complex, it appears that the representatives of smallest size in which the brain is large as compared to the body, may be lissencephalous, as for example in the case of little marmoseh monkey among the Primates. In the carnivora, pinnipedia, cetacea and ungulata certain accurate fissures arch over the sylvian—itself to be classed with the radial fissures —and in the most typical cases form three concentric gyri, which, enumerated from the sylvian fissure outwards, are the sylvian, supra-sylvian and marginal gyri. Where it is deep, the sylvian fissure always hides the Insula.

In the carnivorous brain the crucial fissure is a characteristic feature extending from the mesal surface outwards and bounded at its lateral end by the sigmoid gyrus. The mesal surface in this group has a well marked splemal fissure—both longitudinal and accurate in its course, having important relations to the crucial fissure just named.

The homology of the fissure of Rolando with the various fissures in

the carnivorous brain with which it has been compared are merely mentioned and the author passes on to propose the question whether there can not be an occipital lobe without a parieto-occipital fissure and decides that there can be if the caudal prolongation of the lateral horn, the post. cornu, is taken as the criterion. Again he argues for the recognition of both frontal and parietal lobes even where the fissure of Rolando is absent. It is plain from what has been said that the convolutions can have very little value in determining phylogenetic relationship and that their significance is not fundamental. The remaining pages are devoted to the various theories of the formation of the convolutions. This is the least satisfactory portion of the paper. It should be added that there are more than forty cuts interpolated in the text, many of them representing the brains of unusual or rare animals.

II.—ASSOCIATION, REACTION.

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HÖFFDING, *Ueber Wiederkennen, Association und psychische Activität.*, Viertelj. f. wissensch. Philos. 1889 XIII 420; 1890 XIV 27, 167, 293.

LEHMANN, *Kritische und experimentelle Studien über das Wiedererkennen*, Phil. Stud. 1891 VII 169.

WUNDT, *Bemerkungen zur Associationslehre*, Phil. Stud. 1891 VII 329.

JASTROW, *A statistical study of memory and association*, Educational Review, 1891 II 442.

RIBOT, *Enquête sur les idées générales*, Rev. Philos. 1891 XXXII 376.

MUENSTERBERG, *Zur Individualpsychologie*, Centralbl. f. Nervheilkunde, 1891 XIV 196.

DUMAS, *L'Association des idées dans les passions*, Rev. Philos. 1891 XXXI 483.

The papers by Prof. Höffding, Dr. Lehmann and Prof. Wundt are intimately related to each other, as well as to preceding articles and text-books. Höffding criticises Lehmann's previous paper "Ueber Wiedererkennen" (Phil. Stud. 1888, V 96-156), in which the latter maintained that it is not necessary to assume similarity as a principle of association. Höffding argues for the integrity of association by similarity, laying special stress on the recognition of previous experiences. In such cases the recognition is the psychological correlate of the greater mobility of the corresponding molecules of the brain. A change which has once taken place occurs the more readily the second time. Lehmann argues that every experience is complex, and that the recognition, even of a comparatively simple sensation, is due to contiguity rather than similarity. Wundt in view of these papers and of Scripture's recent experimental study explains and elaborates the doctrine of association contained in the third edition of his psychology. He holds that simultaneous association should be ranked co-ordinate with successive association, and that the latter depends, as the name itself indicates, on the continuous interweaving of all the ideas under the control of conciousness. We may look on the disagreement of our leading psychologists in these questions without great anxiety, for after all the matter is largely one of nomenclature.

Turning to the experimental results of Lehmann's paper, we find them to be of interest. In his first section he gives the results of 428 trials on